
# The State of Kubernetes 2023

## Presented by VMware

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VMware Tanzu®

# The State of Kubernetes 2023

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# Introduction

This year's report takes a closer look at the impact of Kubernetes on business success. Most respondents this year report seeing operational benefits (98%) ***and*** business benefits (97%). Developer productivity (60%) and IT efficiency (64%) are widely recognized as business benefits. Many stakeholders also see a direct connection between Kubernetes use and bottom-line business benefits, including *the business is seeing growth in market share* (25%), *new revenue-driving customer experiences have been created* (21%), and *profit margins are increasing* (20%).

We also dig deeper on the challenges and opportunities that arise as organizations expand their Kubernetes footprints across multiple clouds.

More than three-quarters of those surveyed utilize multiple clouds, primarily to *reduce vendor dependency* (53%), *manage costs* (45%), and *expand disaster recovery and cloud backup options* (42%).

Significant challenges still exist when it comes to maintaining security and choosing tools for multi-cloud environments. Organizations often rely on a patchwork of technologies, increasing overall complexity. Substantial shifts in security and tooling priorities occur as stakeholders cope with the realities of operating more Kubernetes clusters across more clouds.

## This report is divided into four sections:

### Delivering Value Beyond IT

Kubernetes helps businesses thrive.

### Cloud Chaos to Cloud Smart

Teams must learn to cope with multi-cloud Kubernetes.

### Multi-Cloud Security

Continuous security across clouds is the new frontier.

### Shifting Tool Needs

Teams are increasingly willing to pay for critical tools.

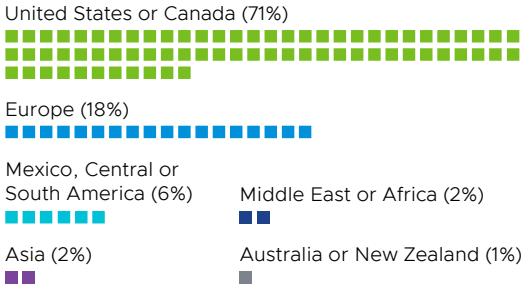
# Demographics

This year's survey included **752 qualified software development and IT professionals,** similar to the number of respondents last year. As in previous years, VMware commissioned Dimensional Research to conduct this survey. Our thanks to the Dimensional team for their diligent work and attention to detail.

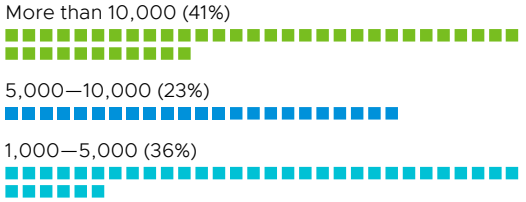
The survey is focused on individuals with responsibility for Kubernetes at companies with 1,000 or more employees, covering a wide range of roles, industries, regions and job levels. For this year's study, we created a more even distribution across the top five industries covered: software, telecommunications, retail, manufacturing, and financial services and insurance. Each of these industries now makes up approximately 13% of the total sample. Dimensional verified that this demographic adjustment hasn't noticeably impacted the results, ensuring that comparisons made with previous years remain statistically valid. As in previous years, a wide range of industries is represented. Additional industries covered in the survey include education (6%), healthcare (5%), services (4%), technology (excluding software, 4%), government (4%), energy and utilities (2%), transportation (2%), media and advertising (1%), and food and beverage (1%).

All the organizations surveyed have a significant software development footprint. About a third (34%) have between 100 and 1,000 developers, 8% have 1,000 to 2,500 developers, and 20% have more than 2,500 developers.

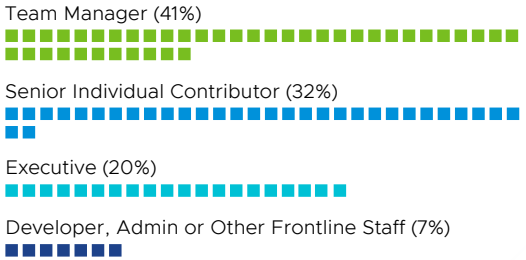
### Region



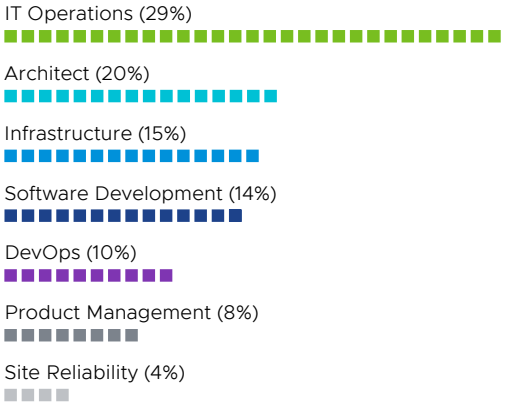

### Company Size (# of Employees)



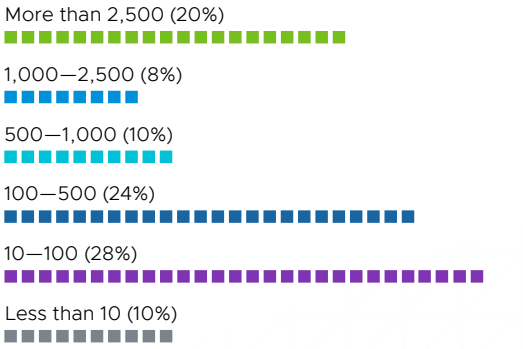

### Job Level




### Primary Job Responsibility




### Number of Software Developers



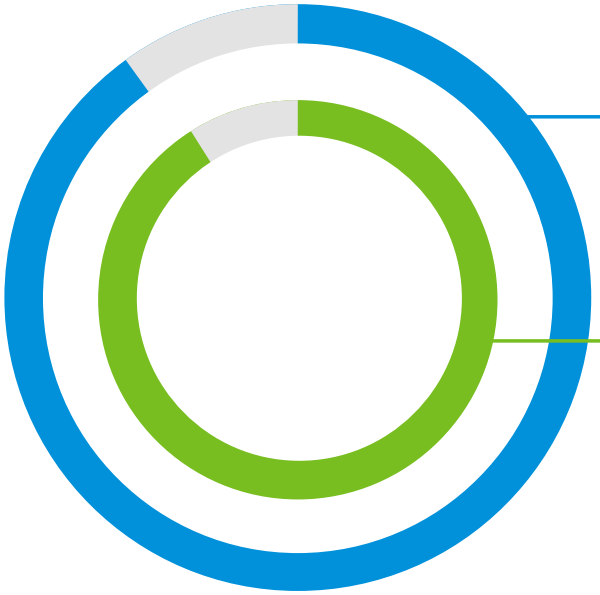
# Delivering Value Beyond IT

**We've been tracking the operational benefits of Kubernetes since we launched this survey five years ago. With Kubernetes entering the IT mainstream, it's time to examine how Kubernetes' operational advantages impact the business as a whole. The short answer is the benefits are substantial—97% report seeing business benefits—including growth in market share and increased profits.**

## Benefits are visible beyond IT

Kubernetes stakeholders report that the benefits of Kubernetes and cloud native technologies extend beyond the boundaries of IT. Nine out of 10 (90%) agree that *cloud native technology, including Kubernetes, is transforming the way our business operates.* And 91% agree that *Kubernetes has benefited our entire organization, not just IT.*

More and more teams embrace cloud native to drive down costs and accelerate the pace of development—and Kubernetes is delivering.



90%

Agree that *cloud native technology, including Kubernetes, is transforming the way our business operates*

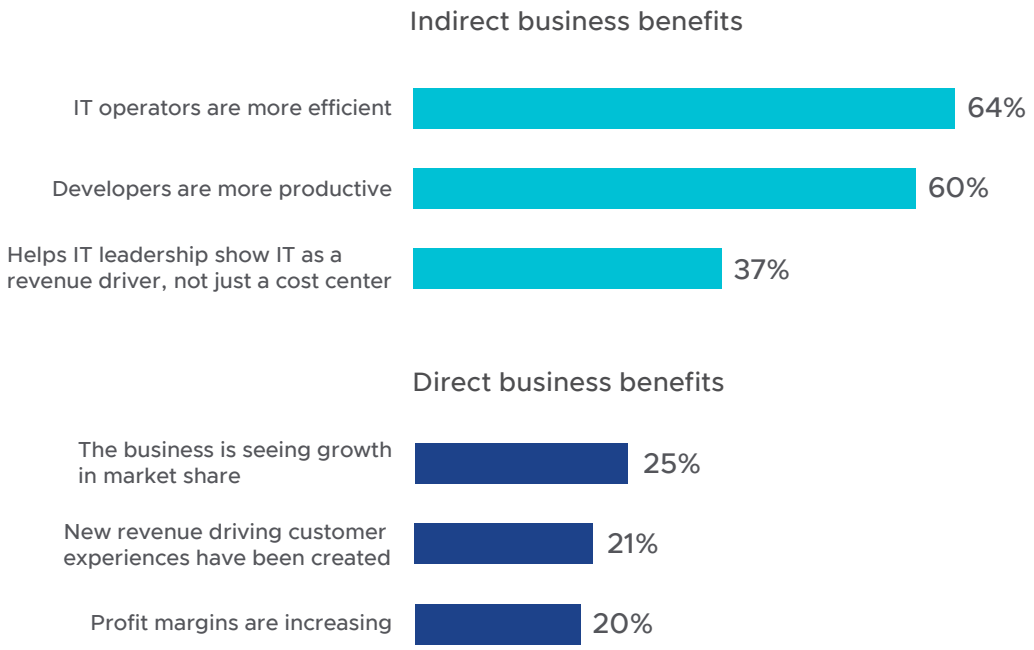
91%

Agree that *Kubernetes has benefited our entire organization, not just IT*

# Kubernetes yields a range of business benefits

Digging deeper, the top two business benefits relate to the effectiveness of operations and development teams: *IT operators are more efficient* (64%), and *developers are more productive* (60%). These benefits—especially developer productivity—are inordinately impactful given today's reliance on digital technologies. Increasing developer productivity, removing complexity, and reducing toil provide a faster path to production and reduce time to market, which reduces time to value. More than a third (37%) report that Kubernetes *helps IT leadership show IT as a revenue driver, not just a cost center.*

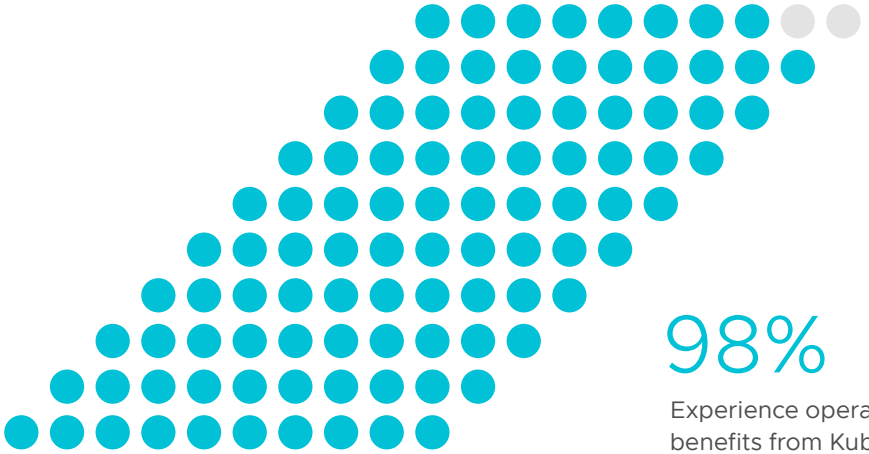
Three additional benefits demonstrate that many technology stakeholders now see a direct impact to the bottom line as a result of using Kubernetes: *the business is seeing growth in market share* (25%), *new revenue-driving customer experiences have been created* (21%), and *profit margins are increasing* (20%). These benefits indicate that Kubernetes delivers a significant return on investment (ROI) for many organizations. We'll be keeping a close eye to see if these benefits continue to grow in subsequent studies.



# Continuing operational benefits

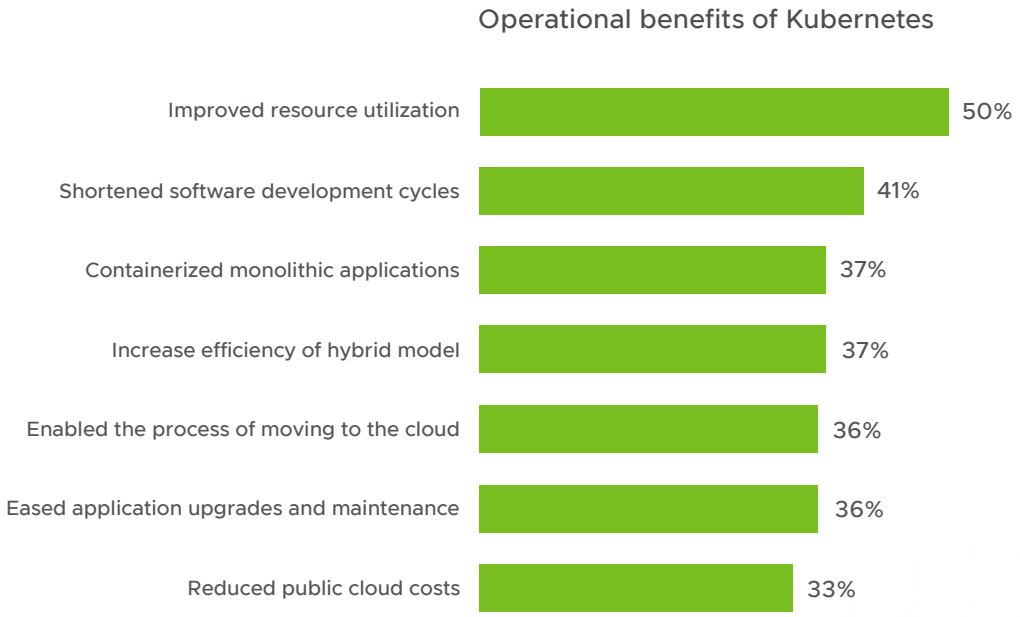
When we asked about *operating Kubernetes*, 98% of stakeholders reported seeing benefits. The top benefit was *improved resource utilization* (50%) followed by *shortened software development cycles* (41%).

Several cloud-specific operational benefits are also notable: *enabled the process of moving to the cloud* (36%) and *reduced public cloud costs* (33%). Kubernetes increases cloud success and facilitates the hybrid and multi-cloud operations that have become essential to digital business.



98%

Experience operational benefits from Kubernetes



# From Cloud Chaos to Cloud Smart

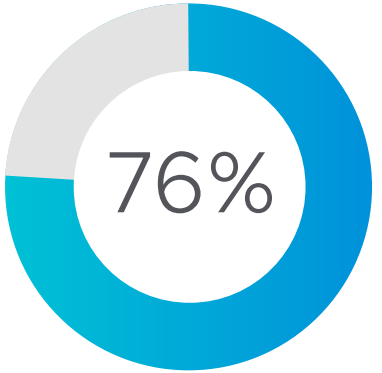
**As organizations expand their multi-cloud Kubernetes footprints, many deployment and management challenges are trending up, including *inadequate internal experience*, *difficulty integrating with current infrastructure*, and *lack of app mobility*. By choosing Kubernetes distributions and tools carefully, enterprises can reduce complexity and gain the freedom to run any application in any cloud.**

## The state of cloud adoption

Multi-cloud—which is defined here as *multiple public cloud vendors or a mix of public and private cloud*—has become the dominant deployment type. More than three-quarters of those surveyed (76%) utilize *multiple clouds*. The percentage with multi-cloud operations is even higher in industries such as telecom (89%), financial services and insurance (87%), and software (84%).

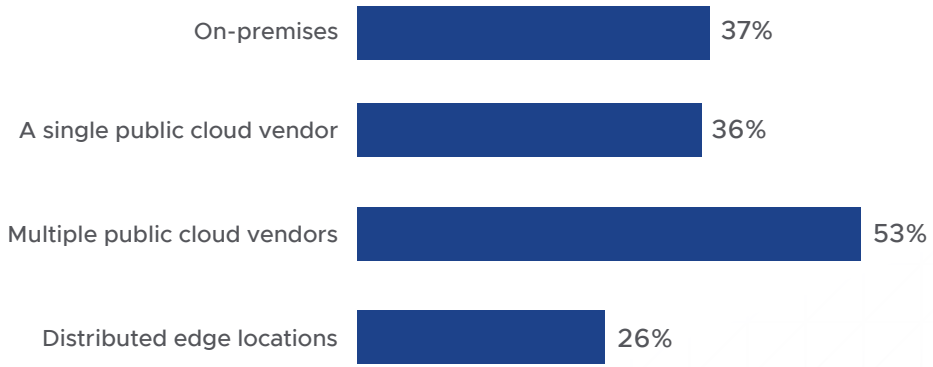
When asked where organizations have *currently* deployed Kubernetes, 44% are *hybrid* and 44% are *cloud only*. Just 10% of respondents say they are *on-premises only*, down from 15% two years ago.

And future plans are clearly multi-cloud. More than half (53%) plan to add or increase capacity across *multiple public cloud vendors* compared to 37% expanding *on-premises* and 36% expanding in *a single public cloud*.



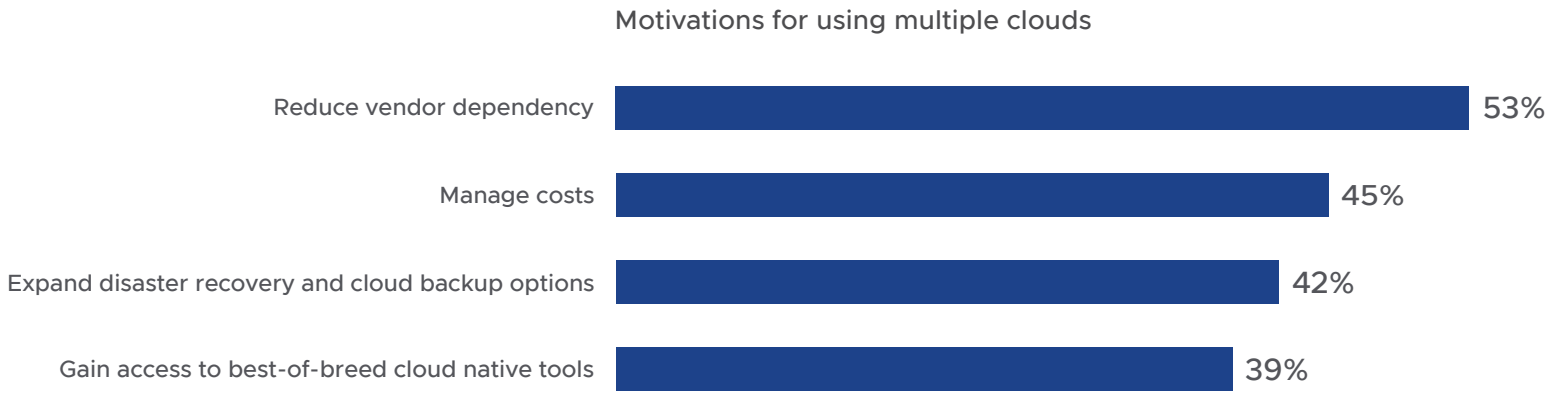

Utilize multiple clouds

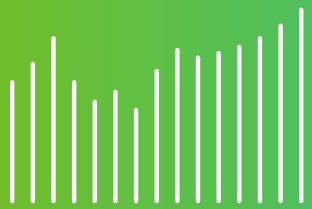
Where do you plan to add or increase Kubernetes deployments in the coming year?



# Why multi-cloud?

Last year's report speculated that multi-cloud was increasing in popularity *for reasons of availability, geographic reach, and avoiding vendor lock-in.* This year, we asked the question directly and our intuition has been largely confirmed. *Reducing vendor dependency* was the top reason for using multiple clouds at 53%, followed by *managing costs* (45%), and *expanding disaster recovery and cloud backup options* (42%).



## Edge deployment plans on the rise

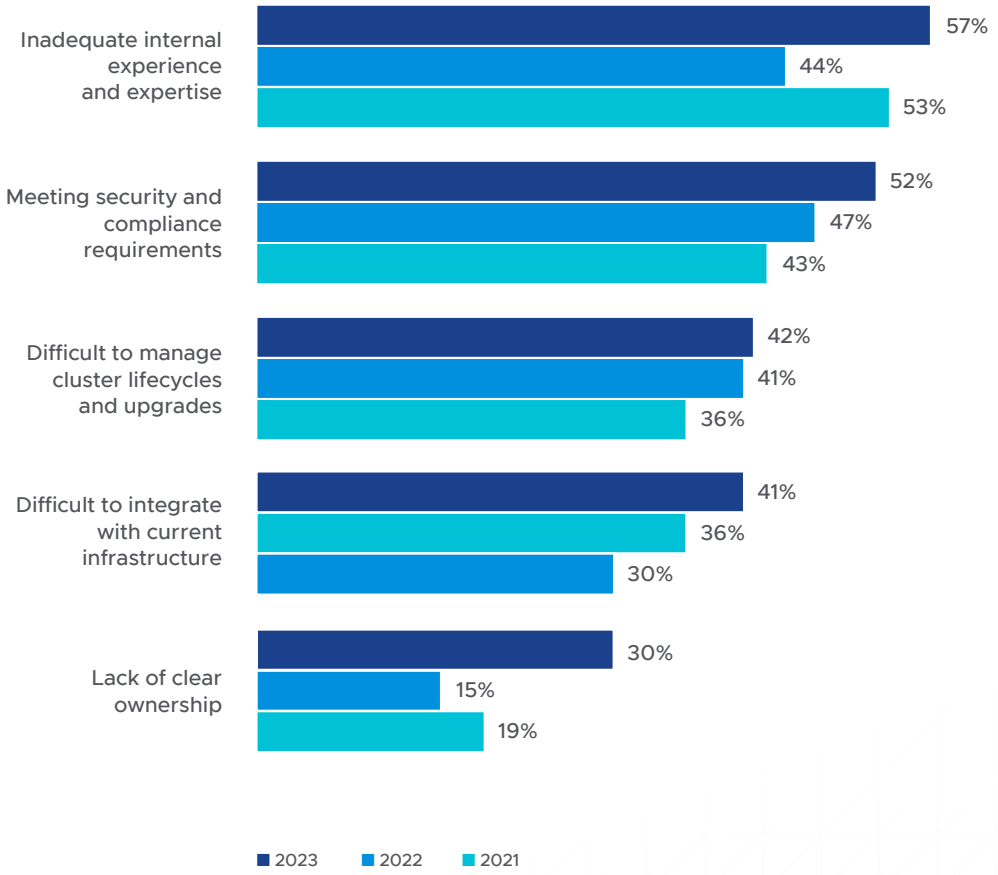
Kubernetes is finding its way into every IT environment, including the edge. More than a quarter (26%) of respondents intend to add or increase distributed edge deployments in the next year, compared to 20% last year, making it the environment with the biggest year-on-year growth. Kubernetes contributes significantly to edge computing success, but teams must be able to manage clusters remotely and at scale.

# Multi-cloud challenges

While multi-cloud is the preferred deployment model for Kubernetes, it's not all smooth sailing. When we look at Kubernetes **deployment challenges**, we see several that had been trending down over the past few years ticking back up. Notably, *inadequate internal experience and expertise* increased 6 percentage points to 58%. This likely means that IT staff are struggling in the face of multi-cloud operations or struggling to keep up with rapid growth of the Kubernetes footprint, or both. In addition, *difficult to integrate with current infrastructure* went up 12 percentage points to 50%, and *lack of app mobility* ticked up 7 points to 21%. The last trend is particularly interesting because *application mobility* is one of the unique benefits of Kubernetes. One explanation can be that, as companies expand to multiple clouds, they realize their applications are locked in due to use of unique features or proprietary services only available from a single cloud vendor. We take a closer look at tool choices for multi-cloud environments later.

Turning to **management challenges**, we see that all challenges have trended up since 2022, and—once again—there's a notable uptick for *inadequate internal experience and expertise*, up 13 points to 57%.

What challenges has your organization encountered managing Kubernetes?



# Going from cloud chaos to cloud smart

At VMware Explore 2022, VMware CEO Raghu Raghuram explained that the typical cloud journey can be broken down into three phases:

**Cloud first** — Embrace public cloud; focus on building customer-facing apps.

**Cloud chaos** — Greater cloud choice leads to a massive spike in complexity; many organizations are currently here.

**Cloud smart** — The freedom to select the right cloud for the right app.

Cloud smart means having the ability to run the same Kubernetes distribution and tools in all public clouds, on-premises, and at the edge. So your applications will run everywhere and be developed, deployed and managed using the same toolsets with minimal cloud-specific knowledge or outside dependencies.

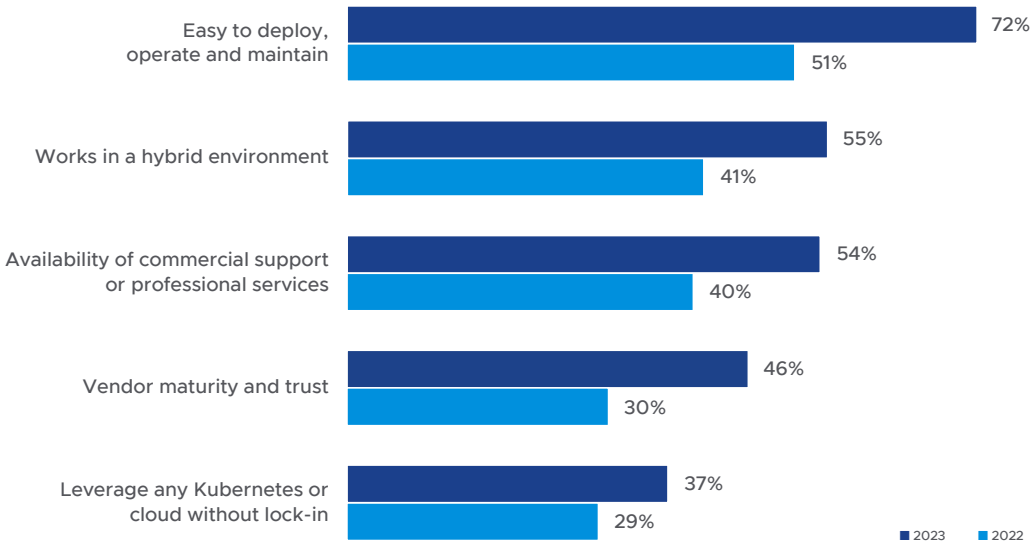
# Choosing Kubernetes distribution for multi-cloud success

Given the importance of selecting the right Kubernetes distribution to address multi-cloud requirements, it shouldn't be surprising that we see upticks in all Kubernetes selection criteria this year.

*Easy to deploy, operate and maintain* remains the No.1 criterion; 72% of respondents selected this option, **up 21 points from last year.** The No.2 option is *works in a hybrid cloud environment* (55%), **up 14 points since last year,** and the No.3 option is *availability of commercial support or professional services*, **also up 14 points since last year.**

Also notable are *vendor maturity and trust*, **up 16 points** (46%), and *leverage any Kubernetes or cloud without lock-in*, **up 8 points** (37%). New selections introduced this year are *modularity and works in edge environments*, each chosen by almost a quarter of respondents.

Criteria for selecting a Kubernetes distribution




**How can you streamline multi-cluster, multi-cloud operations?**

As your operations expand, it's critical to identify tools that will streamline multi-cloud operations while increasing automation and providing deeper visibility. VMware Tanzu® for Kubernetes Operations is designed to deliver a simplified, consistent approach, combining the right tools with automation, security, and data-driven insights.

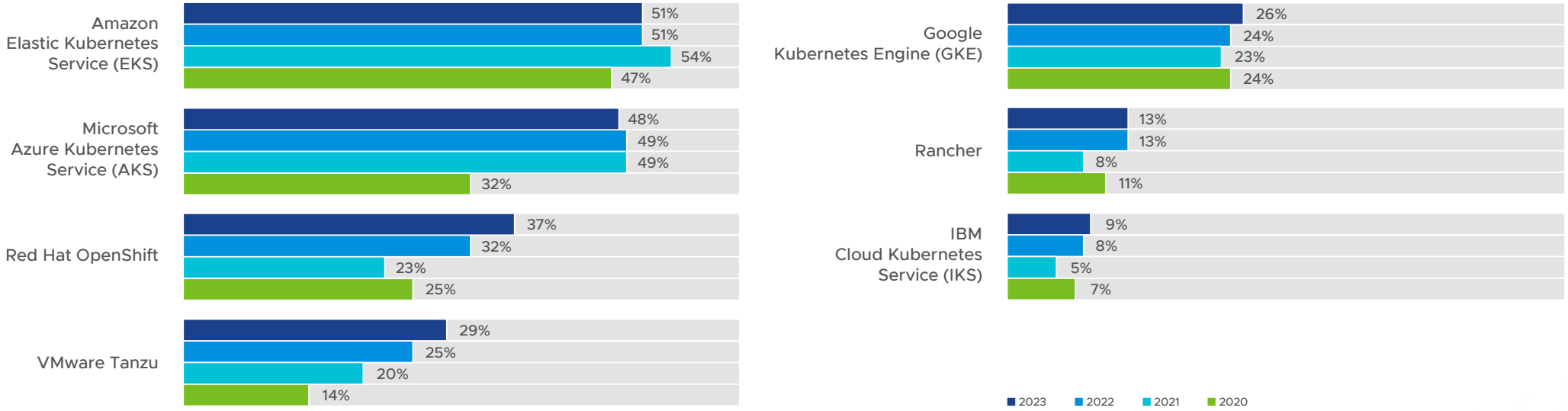
**Tanzu for Kubernetes Operations includes:**

- VMware Tanzu Mission Control™ — A hub for simplified, multi-cloud, multi-cluster Kubernetes management with centralized policy-based management and advanced security controls
- VMware Tanzu Service Mesh™ — Multi-cloud and multi-runtime connectivity for distributed applications with Zero Trust security and automated DevSecOps workflows plus visibility and analytics across users, microservices, APIs and data

# Which Kubernetes offerings do your peers choose?

When we look at the Kubernetes offerings in use, the data supports the shift in selection criteria previously noted. While the offerings from Amazon and Microsoft remain in wide use (each deployed by around half of stakeholders), they are no longer gaining ground. Meanwhile, several popular Kubernetes distributions—capable of running in public clouds, on-premises, and at the edge—are seeing increased usage. This includes VMware Tanzu, which has seen consistent growth every year.

Which Kubernetes offerings do you currently use?



# Multi-Cloud Security

**It hardly needs to be said that security is a challenge across the entire IT landscape. Last year, Kubernetes security concerns were focused on multi-cluster, multi-cloud environments. Because security controls differ from one cloud to the next, multi-cloud increases the risk of leaving the door open to cybercriminals. This trend continues for 2023, with 97% reporting ongoing security challenges. However, the pain point is shifting from secure deployment to maintaining security. The top security concern for more than half of stakeholders is *misconfigurations/exposures.***

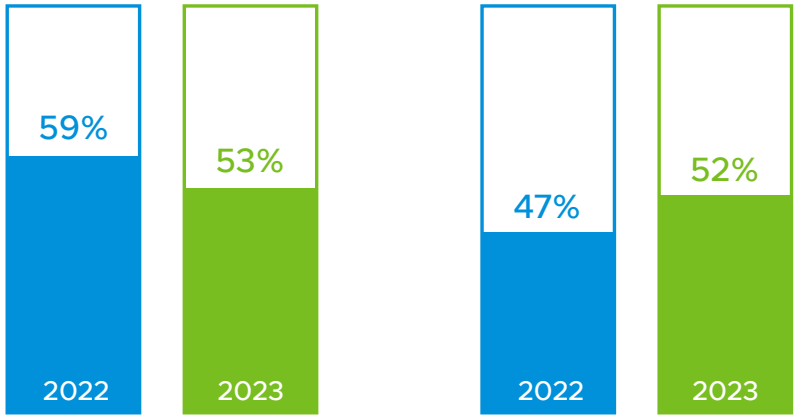
## Maintaining security is a growing pain point

Ensuring security across hybrid and multi-cloud environments is complex. This year's survey suggests that the pain point is shifting from ensuring security at the time of deployment to maintaining the security of multi-cloud, multi-cluster environments over time.

*Meeting security and compliance requirements* is the No.2 challenge for both ***deploying*** and ***managing*** Kubernetes this year. However, it is trending down as a deployment challenge—dropping 6 points to 53%—while trending up as a management challenge—gaining 5 points to 52%.

Teams are apparently getting better at deploying Kubernetes securely—even across different clouds—but **struggling to maintain security** in multi-cloud environments.

Challenge: Meeting security and compliance requirements




## Security teams taking a more active role in Kubernetes operations

With cybercrime increasing every year, perhaps it's not surprising that security teams are taking a more active role in Kubernetes operations. In our 2021 survey, just 15% said that security teams had an active role in Kubernetes operations. **This year, 23% of stakeholders say that security teams are getting involved.**

## Kubernetes security concerns

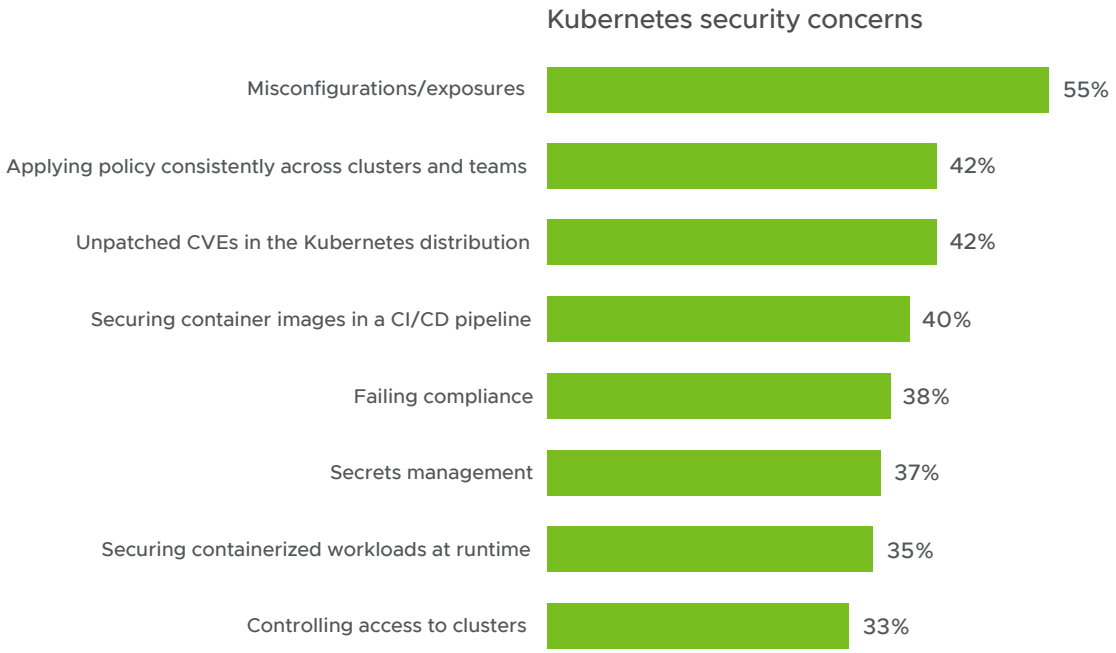
A new question in our 2023 survey reveals stakeholders' specific Kubernetes security concerns. The top concern is *misconfigurations/exposures* (55%). As organizations expand into more clouds, the risk of misconfigurations increases.

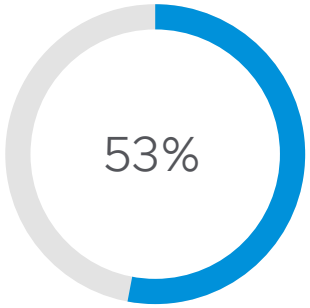
Other notable concerns—ones likely made more challenging by multi-cloud—include *applying policy consistently across clusters and teams* (42%), *unpatched CVEs in the Kubernetes distribution* (42%), *failing compliance* (38%), and *controlling access to clusters* (33%).

To adequately address these concerns, enterprises need security tools that operate efficiently across multi-cloud environments. Embracing shift-left security, providing secure software supply chains, automating patching and container builds, and including a software bill of materials and other modern security practices have become a necessity.

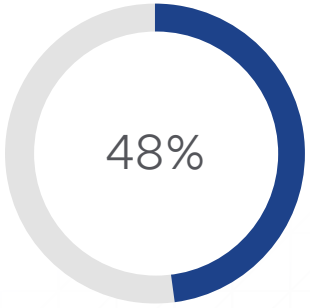
## Stakeholders are most willing to pay for security tools

We'll dig deeper into Kubernetes tools shortly, but it's worth noting that more than half of survey respondents (53%) said *data security, protection and encryption* is the most useful category of tools for Kubernetes in production. This puts security at the top of the list alongside *platform monitoring and alerting*. Almost half of all stakeholders (48%) are willing to *invest in paid support or services* for security tools, putting it at the top of that list as well.




Tools for *data security, protection and encryption* ranks as No.1 in usefulness for Kubernetes in production




Almost half would invest in *paid support or services* for *data security, protection and encryption* tools

# Shifting Tool Needs

**To succeed with multi-cloud Kubernetes, you need the right tools for the job. Significant shifts occurred in the tools that stakeholders view as useful this year, with policy-based management, infrastructure as code, and cluster ingress gaining the most ground. Stakeholders are increasingly willing to pay for critical tools to ensure success.**

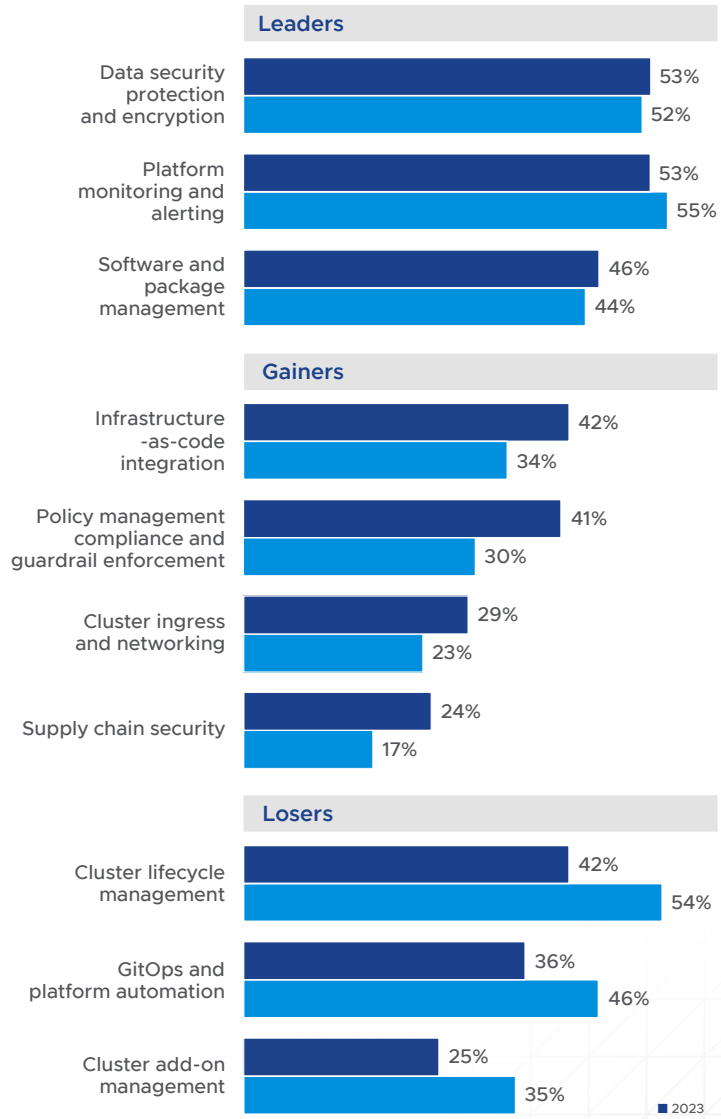
## Tool priorities are evolving

The shift to multi-cloud is having an impact on tool priorities similar to the effect on security. The top three useful types of tools this year are *data security, protection and encryption* (chosen by 53% as noted earlier); *platform monitoring and alerting* (53%); and *software and package management* (46%). Each of these is within 1 or 2 percentage points of last year. Further down the list, however, there have been significant shifts in the rankings, with some tools trending up and others down.

Notable among the tools trending upward are *infrastructure-as-code integration* (42%, up 8 points); *policy management, compliance, and guardrail enforcement* (41%, up 11 points); *cluster ingress and networking* (29%, up 6 points); and *supply chain security* (24%, up 7 points). While you can make a case for increases in the usefulness of all these tool categories as Kubernetes operations mature and expand, automation, policy-based management, and advanced networking are likely to be particularly valuable in large-scale, multi-cloud environments.

*See State of the Software Supply Chain: Open Source Edition 2022 to learn more about supply chain security.*

Tools for operating Kubernetes in production

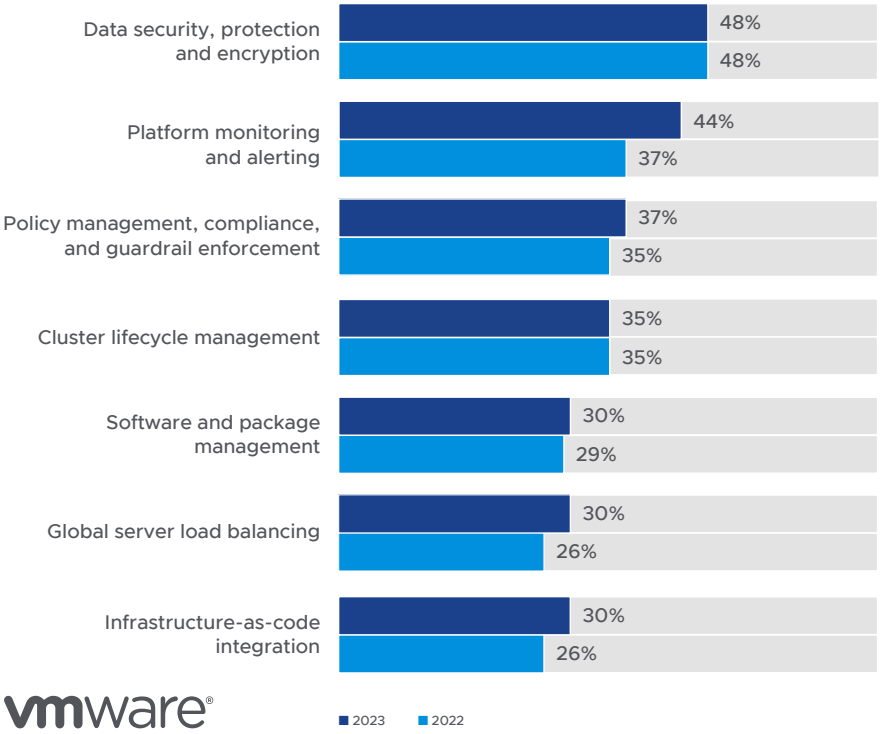


## Kubernetes stakeholders are increasingly willing to pay for tools

A trend that we first began tracking last year, *willingness to invest in paid support or services* for important tools continues to gain momentum, with all classes of tools either remaining the same or ticking up this year.

Notable gainers include *platform monitoring and alerting* (selected by 44% of respondents, up 7 points compared to 2022), *policy management, compliance, and guardrail enforcement* (37%, up 2 points), *global server load balancing* (30%, up 4 points), and *infrastructure-as-code integration* (30%, up 4 points).

### Tools that stakeholders are most willing to pay for

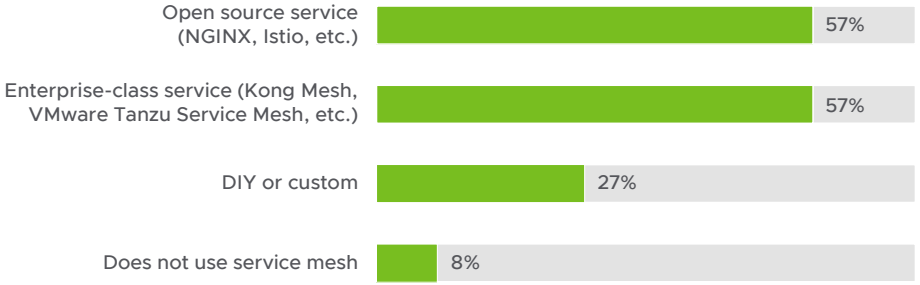



## Service mesh adoption is high

One tool we wanted to know more about was service mesh, so we added a separate question on the technology. Most organizations (92%) have some type of service mesh deployed, underscoring its growing importance for enterprise application connectivity. We see an even split between use of *open source and enterprise-class* options, each selected by 57% of respondents, while 27% use a *DIY or custom* implementation.

Note that these categories are not mutually exclusive. Enterprise-class and DIY service meshes can be built on an open source foundation.

### Service meshes in use with Kubernetes



# Summary and Recommendations

Our key finding for 2023 is that Kubernetes is delivering measurable business benefits that extend beyond the boundaries of IT. Nine out of 10 (90%) respondents agree that *cloud native technology, including Kubernetes, is transforming the way their business operates.* Almost two-thirds of stakeholders report seeing indirect business benefits, such as *developers are more productive* (60%) and *IT operators are more efficient* (64%). A significant number recognize direct benefits—ones that directly affect the bottom line—including *the business is seeing growth in market share* (25%), *new revenue-driving customer experiences have been created* (21%), and *profit margins are increasing* (20%).

As multi-cloud Kubernetes deployments become the norm—76% are utilizing multiple clouds—new challenges appear to be emerging. Many organizations are struggling with cloud chaos, with greater cloud choice leading to a massive spike in complexity. This report highlighted two specific challenge areas: security and tool selection. In both cases, significant shifts are underway as organizations seek to become cloud smart by developing the capabilities necessary to deploy and operate any application in any cloud, efficiently and securely.

One way to become cloud smart is by identifying the distributions and tools that will enable you to deploy, manage and monitor clusters and applications across multi-cloud environments with less specialized expertise in each cloud and less manual toil. **When choosing a Kubernetes distribution, stakeholders prioritize ease of use, hybrid and multi-cloud capability, availability of support and services, vendor maturity, and avoiding lock-in.**

Kubernetes stakeholders are demonstrating an increased willingness to invest in paid support and services for critical tools. The right partners can help guide you to the right tools for your needs and accelerate the transition from cloud chaos to cloud smart. Look for partners who understand Kubernetes and the entire Kubernetes ecosystem, and know what it takes to create and operate modern applications at scale.

# Learn how to set up a secure, multi-cloud Kubernetes platform that simplifies, secures and optimizes your operations.

VMware Tanzu for Kubernetes Operations

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